FIG. 1

FILE STORAGE MANAGEMENT SYSTEM

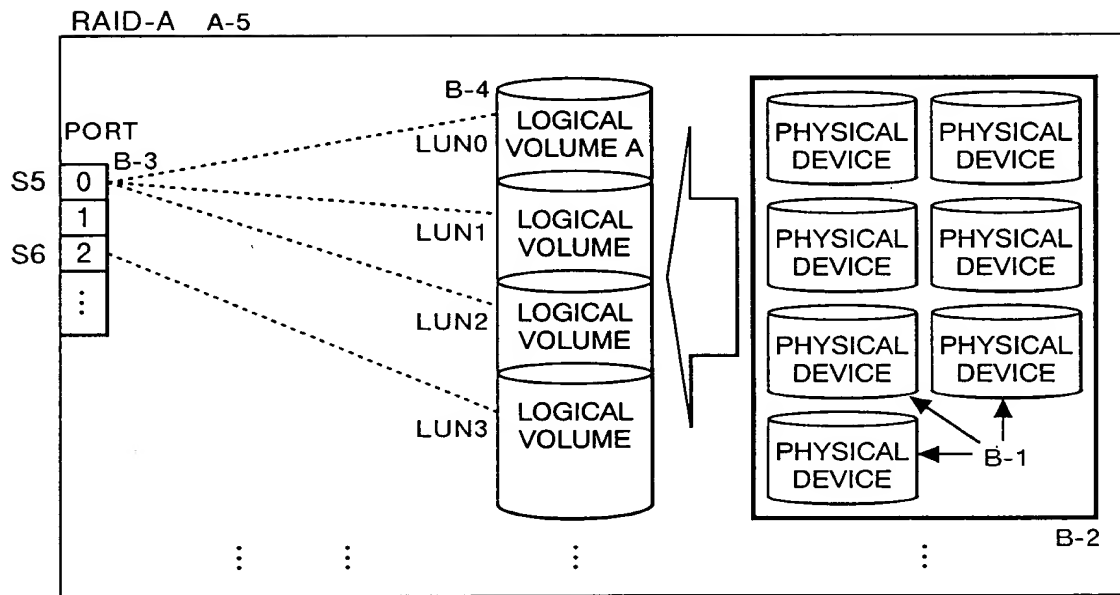# FIG. 2

RAID CONSTRUCTION
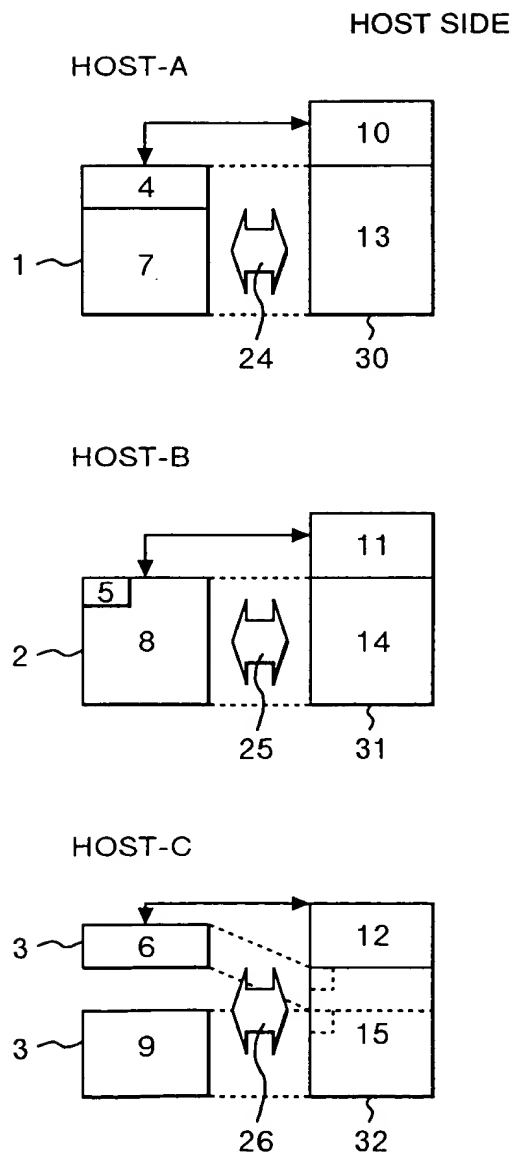
FIG. 3

HOST SIDE

HOST-A

HOST-B

HOST-C

FIG. 4

STORAGE MANAGEMENT IN LUN

B-4

SAN FILE
DIRECTORY
C-1

FILE AREA
C-2

SAN FILE DIRECTORY   C-1

C-1-1 VOLUME LABEL

1 : m

HolderName

C-1-10

1 : n

FileName

C-1-11

C-1-2 OWNER NAME

C-1-3 USER IDENTIFIER

C-1-4 WWn OWNER NAME

C-1-5 SCSI OWNER NAME

C-1-6 CREATION TIME

C-1-7 MODIFICATION TIME

C-1-8 LAST ACCESS DATE

C-1-9 VOLUME ATTRIBUTE

C-1-12 DATA STORAGE
AREA INFORMATION

C-1-13 FILE ATTRIBUTE

C-1-14 FILE ATTRIBUTES

C-1-15 GLOBAL OWNER
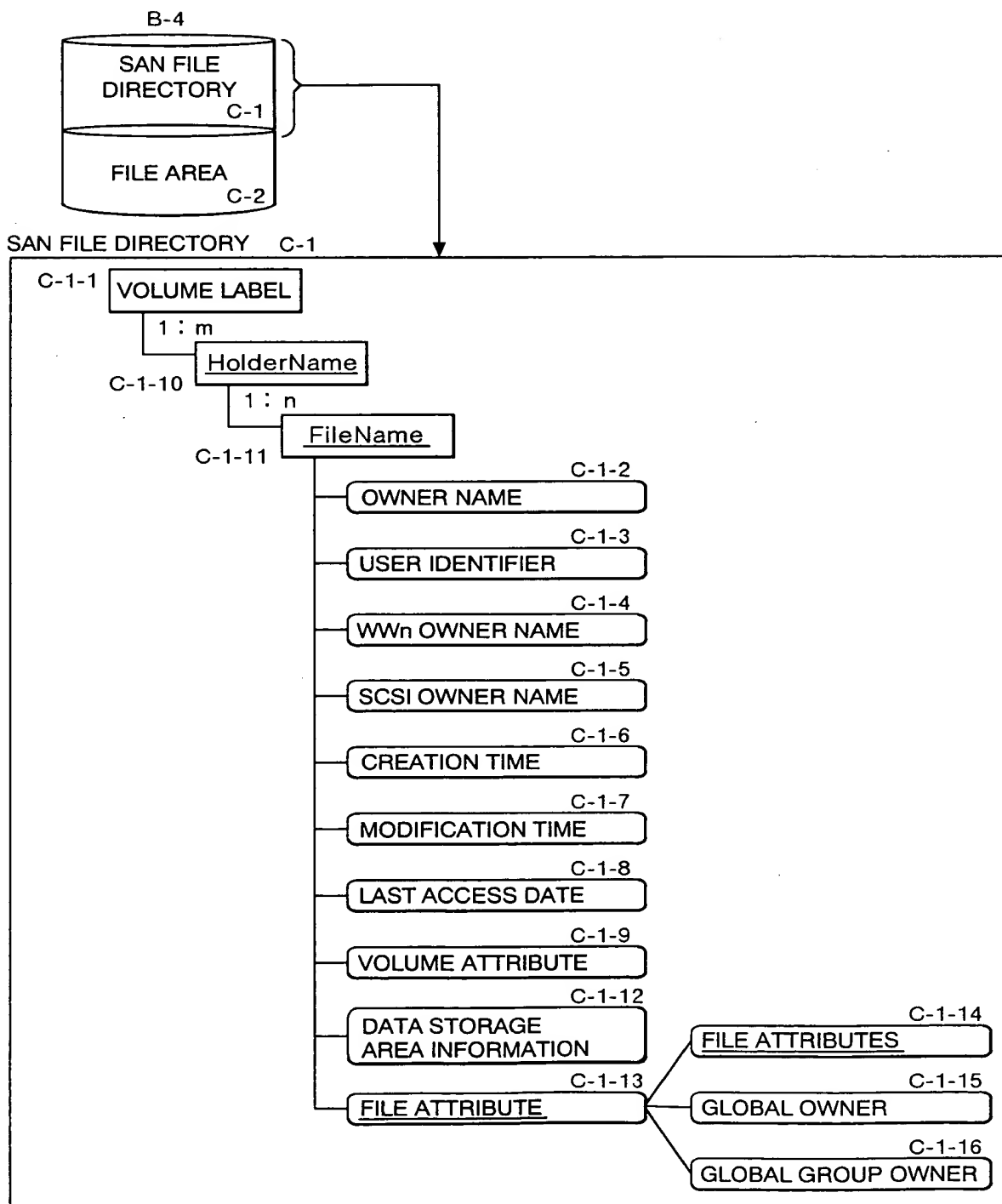
C-1-16 GLOBAL GROUP OWNER

FIG. 5

STORAGE MANAGEMENT IN LUN

D-1 SAN FILE DIRECTORY (SAN-FD)

FileName	DATA STORAGE AREA INFORMATION	FILE ATTRIBUTE	VOLUME LABEL	OWNER NAME	USER IDENTIFIER	WWn OWNER	SCSI OWNER
CREATION TIME	MODIFICATION TIME	LAST ACCESS DATE	VOLUME ATTRIBUTE		HolderName		
ssssssss	hhhhhhh	RRRRR	VOL1	TTTT	QQQQQ	0101000000	I1T2L3
xxxxxxxh	xxxxxxxxxxk	xxxxxxxxxxxl	FFFFFFFF		Holder-A		
ssssssssa	hhhhhha	RRRRA	VOL1	TTTA	QQQQA	0101000001	I1T2L4
xxxxxxxq	xxxxxxxxxxe	xxxxxxxxxxxr	FFFFFFFQ		Holder-B		
..							

FIG. 6

MANAGEMENT DB

RAID-DB   E-1

```
RAID IDENTIFIER
(MAC, TCP/IP ETC.)   E-2
     |
    1:n     WWn OWNER NAME
                        E-3                              E-5
             |                         SYSTEM MANAGEMENT
            1:n     LUN OWNER NAME       INFORMATION
                               E-4                       E-6
                                       SYSTEM ERROR
                                        INFORMATION
```
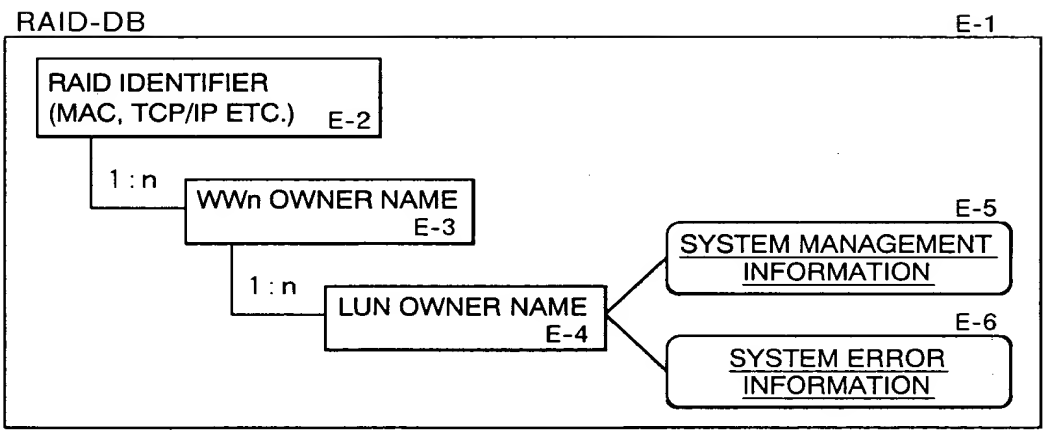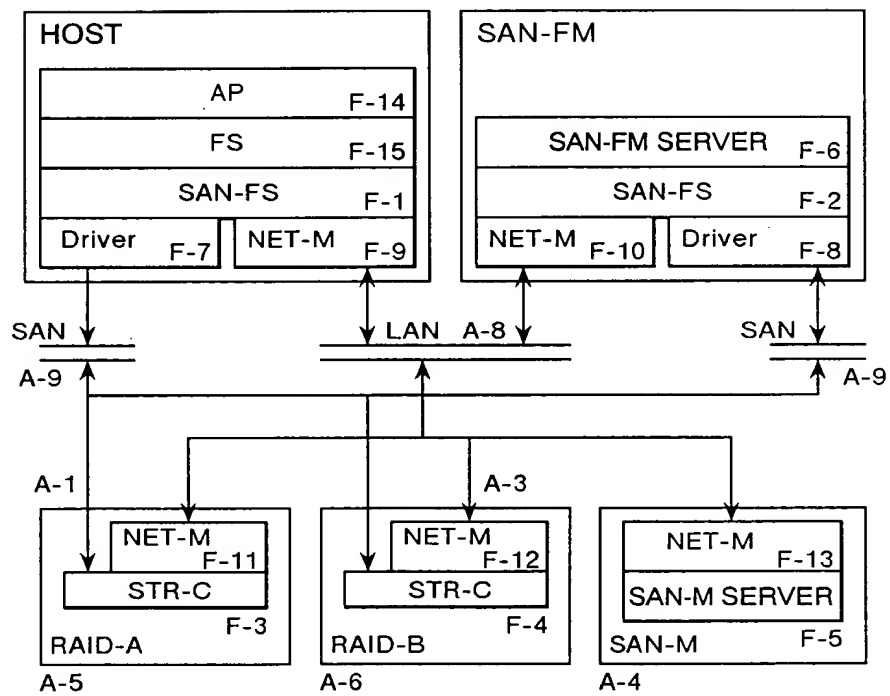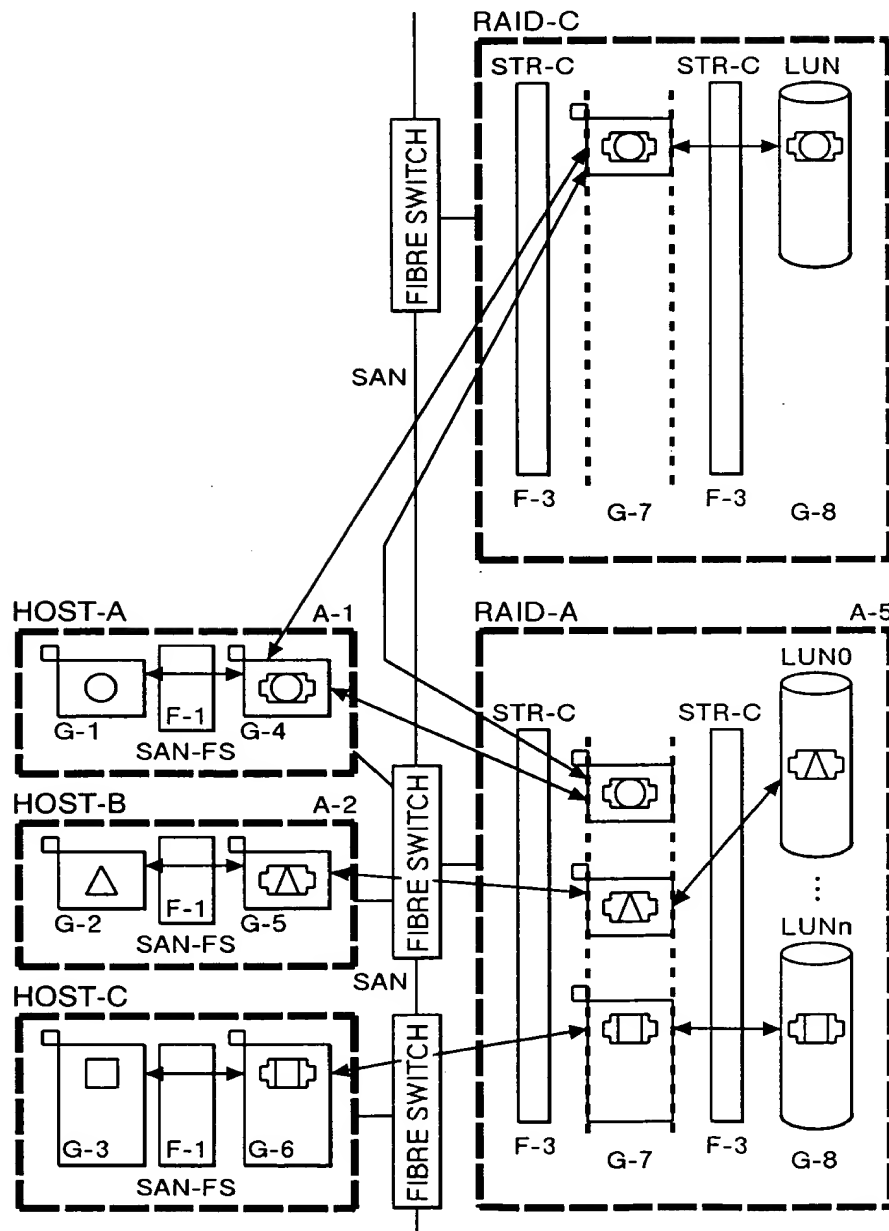
FIG. 7

FILE STORAGE MANAGEMENT SYSTEM

FIG. 8

FILE CONVERSION FLOW

FIG. 9

DB CONFIGURATION FOR FILE STORAGE MANAGEMENT SYSTEM

FIG. 10

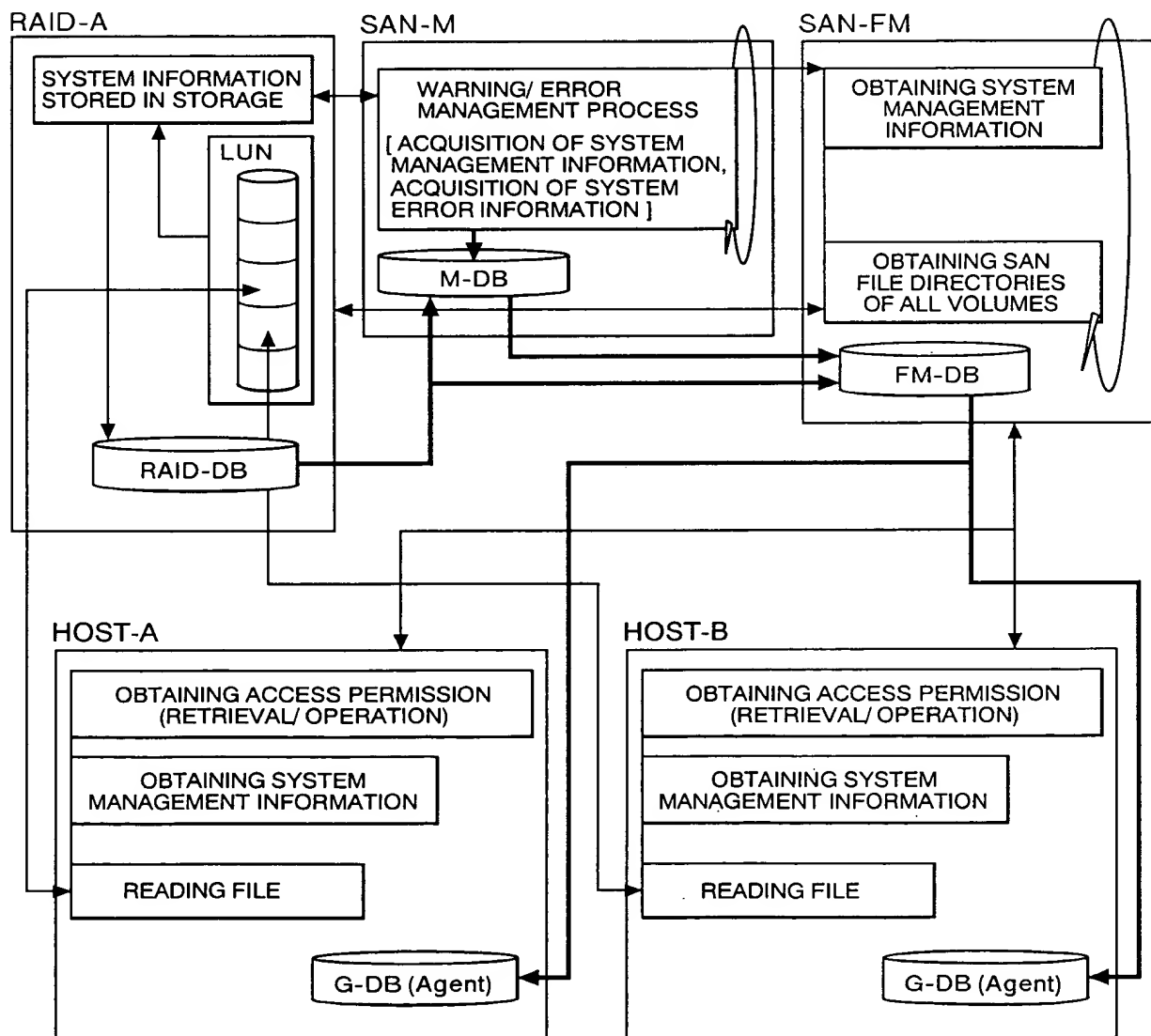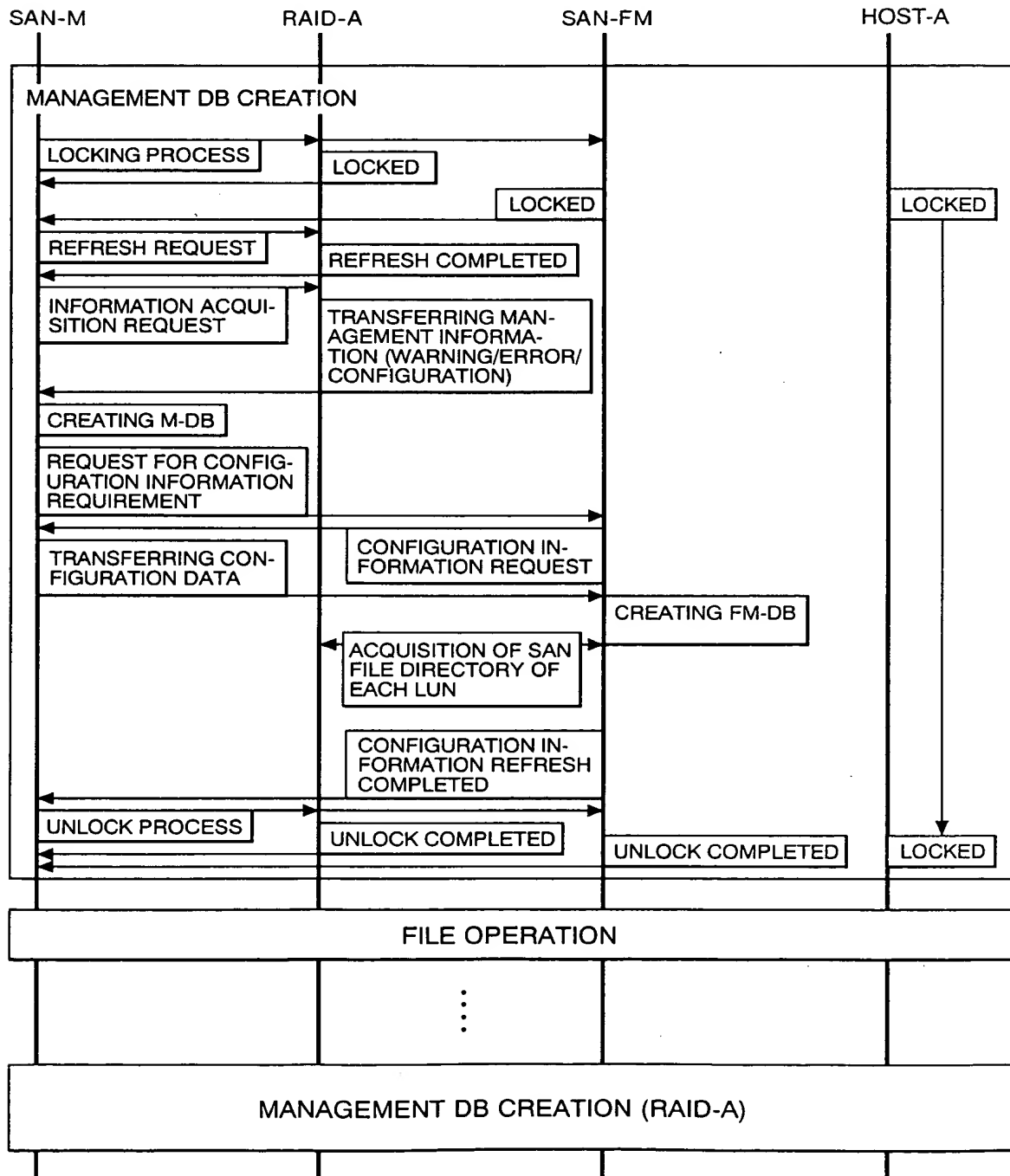DB CONFIGURATION FOR FILE STORAGE MANAGEMENT SYSTEM

SAN-M	RAID-A	SAN-FM	HOST-A

MANAGEMENT DB CREATION

LOCKING PROCESS → LOCKED

LOCKED

LOCKED

REFRESH REQUEST → REFRESH COMPLETED

INFORMATION ACQUI-SITION REQUEST

TRANSFERRING MAN-AGEMENT INFORMA-TION (WARNING/ERROR/CONFIGURATION)

CREATING M-DB

REQUEST FOR CONFIG-URATION INFORMATION REQUIREMENT

TRANSFERRING CON-FIGURATION DATA

CONFIGURATION IN-FORMATION REQUEST

CREATING FM-DB

ACQUISITION OF SAN FILE DIRECTORY OF EACH LUN

CONFIGURATION IN-FORMATION REFRESH COMPLETED

UNLOCK PROCESS

UNLOCK COMPLETED

UNLOCK COMPLETED

LOCKED

FILE OPERATION

⋮

MANAGEMENT DB CREATION (RAID-A)

FIG. 11

FILE OPERATION IN FILE STORAGE MANAGEMENT SYSTEM

SAN-M	RAID-A	SAN-FM	HOST-A

FILE OPERATION

GLOBAL OWNER/ GLOBAL GROUP ACCESS REQUEST

ACCESS PERMISSION (K-1)

TRANSFERRING GROUP INFORMATION

REQUESTING GROUP INFORMATION

CREATING G-DB

STAGING

STAGING COMMAND

REQUESTING ACCESS PERMISSION FOR FILE A

K-2

ACCESS PERMIS-SION FOR FILE A

OPERATION ID FOR FILE A (K-3)

ACCESSING FILE A

TRANSFERRING OF FILE A DATA

DESTAGING

DESTAGING COMMAND

REQUESTING END OF OPERATION OF FILE A

UPDATING RAID-DB

UPDATING FM-DB

UPDATING G-DB
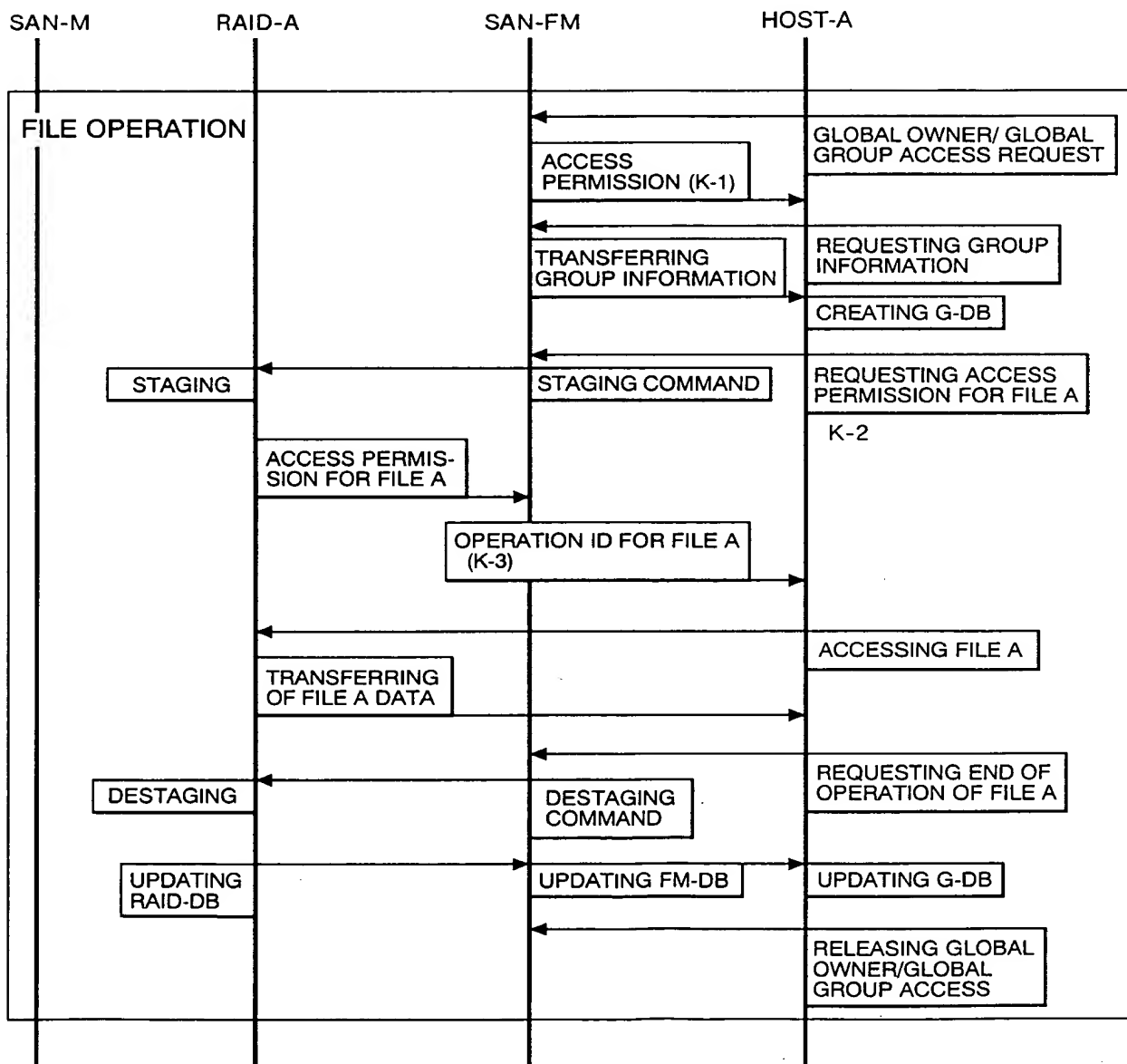
RELEASING GLOBAL OWNER/GLOBAL GROUP ACCESS

FIG. 12

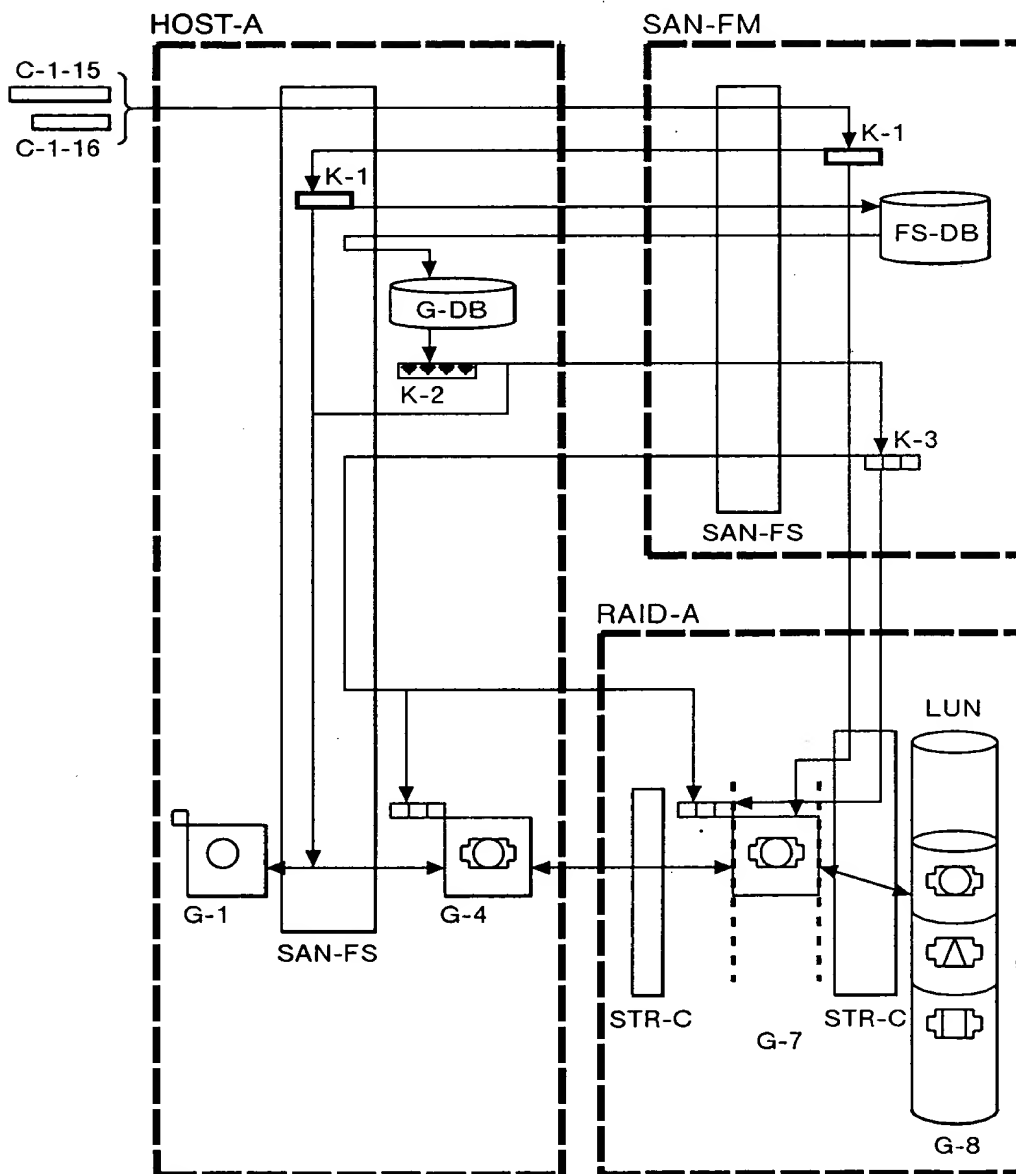FILE OPERATION OF FILE STORAGE MANAGEMENT SYSTEM

FIG. 13
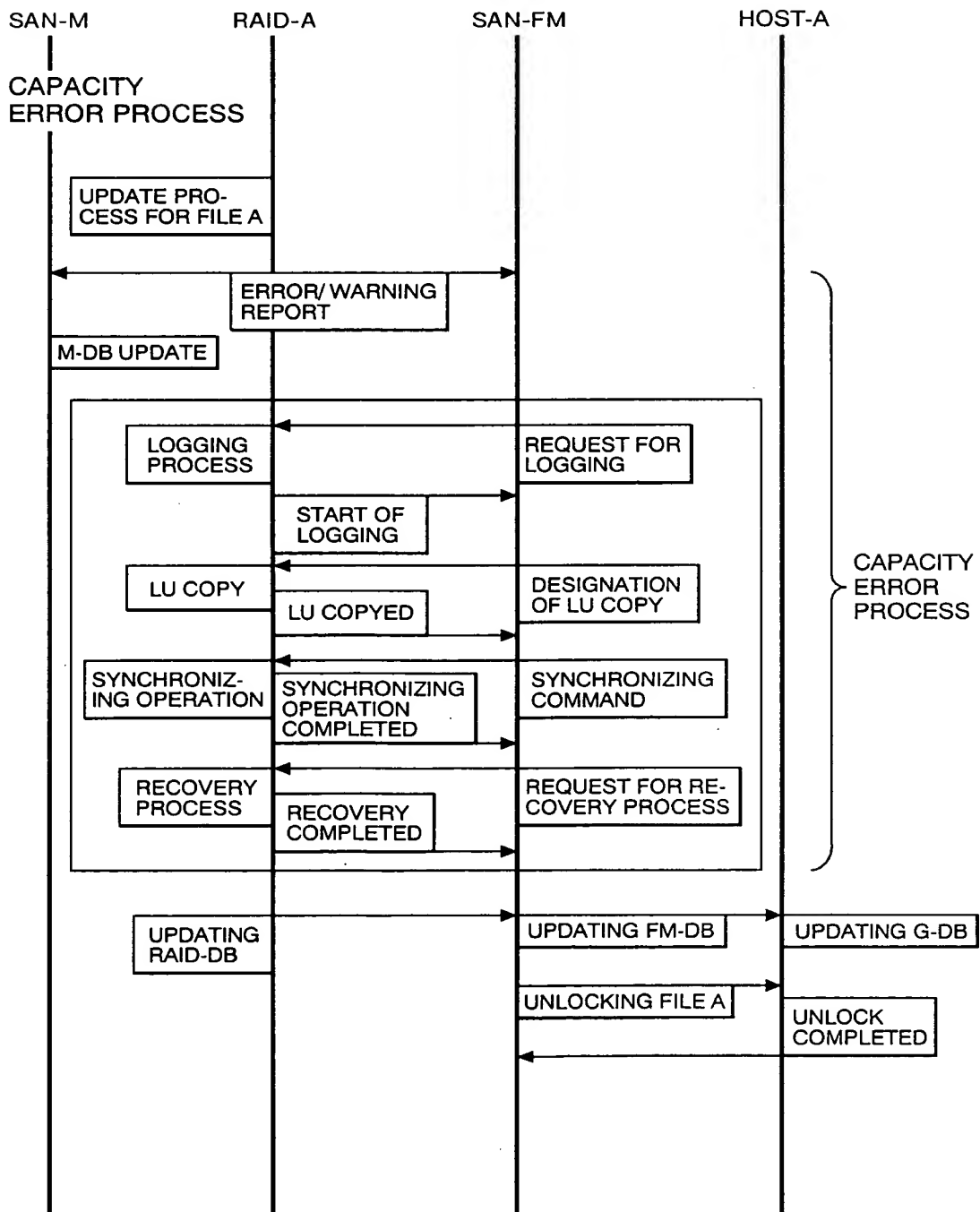
CAPACITY ERROR RECOVERY PROCESS
IN FILE STORAGE MANAGEMENT SYSTEM

FIG. 14

CAPACITY ERROR RECOVERY PROCESS IN FILE STORAGE SYSTEM